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"Development of a Scalable Bottom-Up Nanofabrication Platform"

We have developed a versatile spin-coating technique that combines the simplicity and cost benefits of bottom-up self-assembly with the scalability and compatibility of standard microfabrication. The methodology is based on shear-aligning concentrated colloidal suspensions using standard spin-coating equipment. It enables rapid production of colloidal photonic crystals with remarkably large domain sizes and unusual non-close-packed structures, as well as a myriad of functional nanostructured materials, including plasmonic metallic nanohole arrays, macroporous polymers, 3-D ordered nanocomposites, attoliter microvial arrays, 2-D magnetic nanodots, and more. The spin-coating process also provides a new route to study the fundamental aspects of shear-induced crystallization, melting and relaxation. The broad applications of the assembled periodic nanostructures in integrated optical circuits, surface-enhanced Raman scattering (SERS) based electrochemical and biological sensors, and biomimitic broadband antireflection coatings will also be discussed.